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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/521,984	08/18/2005	Holger Thielert	THIELERT -4 PCT	1926

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WU, IVES J

ART UNIT	PAPER NUMBER
1797	

MAIL DATE	DELIVERY MODE
07/29/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/521,984	THIELERT, HOLGER	
	Examiner	Art Unit	
	IVES WU	1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 May 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2 and 4-6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2 and 4-6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *5/7/2009*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

(1). Applicant's Information Disclosure Statement (IDS), Remarks filed on 5/7/2009 have been received.

The rejection of claim 1 in prior Office Action dated 2/5/2009 is withdrawn in view of the current Remarks.

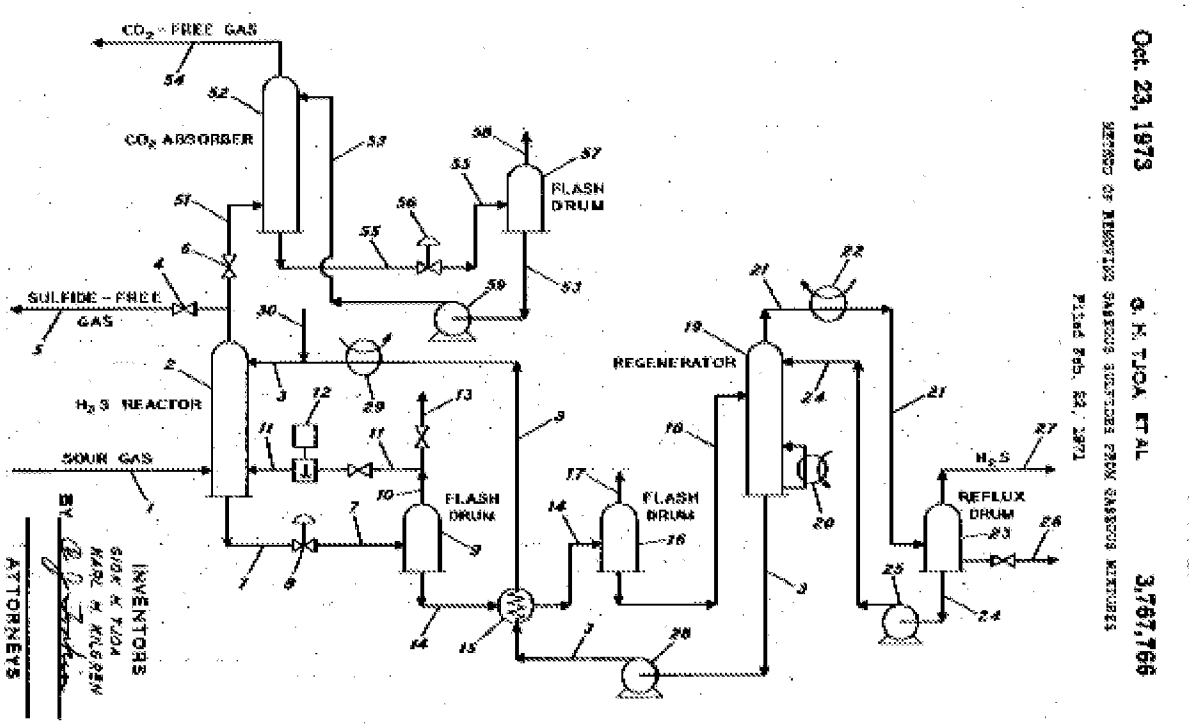
However, a new ground of rejection for claim 1 is introduced and presented with rest of the claims in the following.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

(2). **Claims 1-2, 4-6** are rejected under 35 U.S.C. 103(a) as being unpatentable over Tjoa et al (US 3767766), in view of Heisel et al (US 5628977A), Keller et al (US 20020134706A1) and Luinstra et al (GB 2221853A), evidenced by Mather et al (US 2365893).

As to method for isolating hydrogen sulfide from coke oven gas with subsequent recovery of elemental sulfur in a Claus plant, in which the hydrogen sulfide is removed from the coke oven gas by means of gas scrubbing, using an absorption liquid, the charged absorption liquid is regenerated and, in this connection, hydrogen sulfide that accumulates in concentrated form is passed to the Claus plant in **independent claim 1**, Tjoa et al (US03767766) disclose method of removing gaseous sulfides from gaseous mixtures (Title). While the process has special application to treating gases having the foregoing dilute H_2S content, the process can be applied advantageously to the selective removal of H_2S and like sulfides from fluids having higher concentration of these undesirable sulfides. In addition to natural gas, other suitable feed streams include industrial gas streams (such as obtained in oil refinery operations) as well as flue gases, fuel gases(ie coke oven gas) and hydrogen gas streams contaminated with sulfides (Col. 5, line 71 – Col. 6, line 5). Concentrated H_2S is removed from drum 23 via overhead line 27 for appropriate disposal such as to Claus furnace or acid plant (Col. 9, line 37-40). It is well known in the art that Claus furnace is to recover the elemental sulfur. As illustrated in the following diagram which shows H_2S scrubber 2, regeneration column 19, absorption solution line 3.

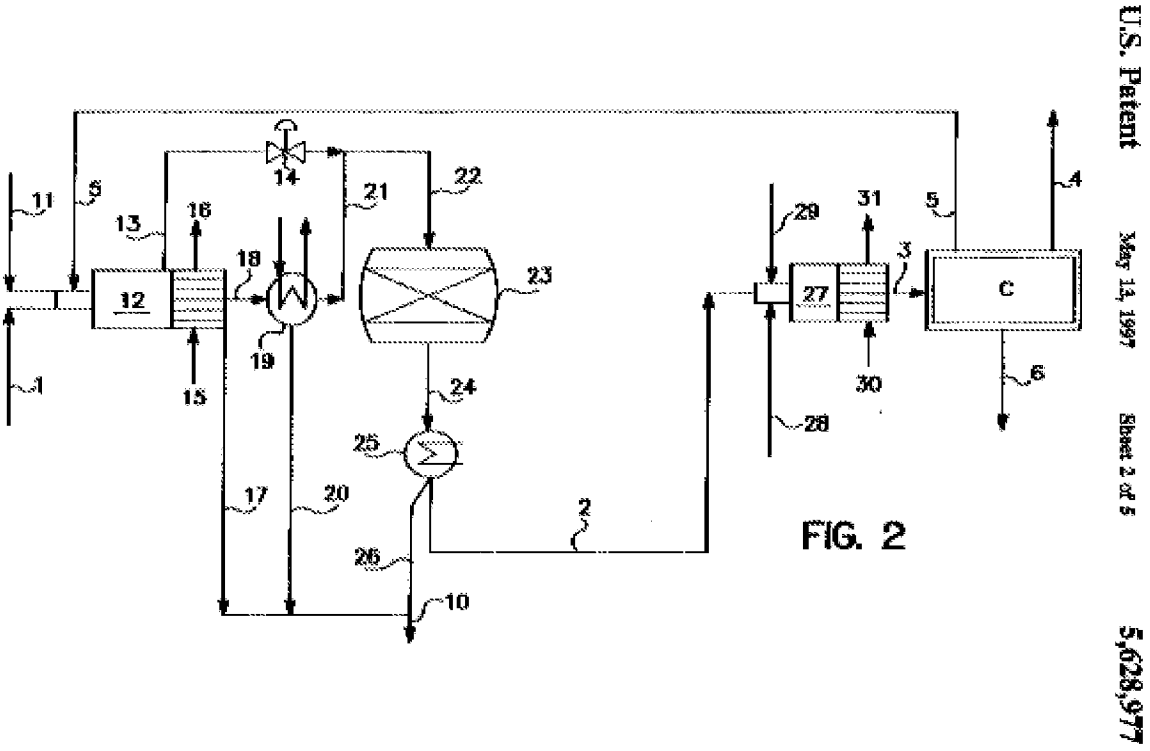


As to hydrogen sulfide being reacted with oxygen in the air, in a Claus boiler of the Claus plant, forming elemental sulfur in the method in **independent claim 1**, it is well known in the art that the reaction in Claus furnace is to react the hydrogen sulfide with oxygen in the air.

As to the process gas leaving the Claus boiler to be cooled to the temperature required for condensation of the sulfur, in a waste heat boiler, heated after the sulfur has been precipitated, and passed to a reaction oven of the Claus plant, in which sulfur compounds are converted to elemental sulfur on the catalyst wherein the process gas that leaves the reaction oven is cooled to a temperature required for condensation of sulfur, and the condensed sulfur is precipitated in the method in **independent claim 1**, Tjoa et al (US03767766) **do not teach** process details of Claus furnace as well as acid plant as claimed.

However, Heisel et al (US05628977A) **teach** process for the desulfurization of a crude gas containing H_2S (Title). As illustrated in the Figure below which shows Claus furnace 12, a part of the Claus reactor waste gas is limited quantitatively by control valve 14 on pipe 13, drawn off hot from Claus furnace, while the residual Claus reactor waste gas is cooled by evaporation of boiler feedwater 15 and drawn off via pipe 18. The steam generated by evaporation of boiler feedwater accumulates in pipe 16. With the cooling of condensed elementary sulfur, it is drawn

off via pipe 17 from Claus furnace 12 (Col. 6, line 25-34). The Claus furnace waste gas at hand in pipe 21 after cooling 19 is mixed with hotter Claus furnace waste gas from pipe 13 and fed via pipe 22 to catalytic reactor 23 (Col. 6, line 37-40). Gas stream 24 that is drawn off from catalytic reactor 23 is cooled (25) and elementary sulfur condensed by cooling 25 is drawn off via pipe 26 (Col. 6, line 45-47).



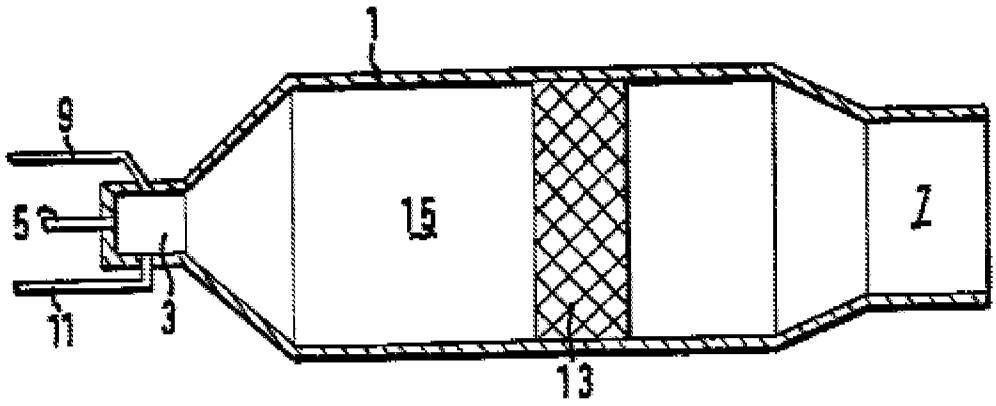
The advantage of Claus plant designed by Heisel et al is to improve the environmental compatibility of entire plant at very high sulfur recovery rates and also especially to reduce the other emissions and accumulating residues, in addition to the sulfur emissions (Col. 2, line 36-41).

Therefore, it would have been obvious at time of the invention to install the Claus plant of Heisel et al as downstream processing of the H_2S recovery plant of Tjoa et al in order to attain the advantages cited above.

As to a boiler lined with a refractory material, lying horizontally, to be used as the Claus boiler which has a combustion chamber and a catalyst chamber having a catalyst bulk material, which follows horizontally and being delimited on both sides by gas-permeable checker bricks in

independent claim 1, Heisel et al (US 5628977A) disclose furnace 12 and boiler next to it as shown in the Figure 2 of Heisel et al above. Tjoa et al and Heisel et al **do not teach** the Clause Boiler construction with a catalyst chamber horizontally with the combustion chamber as claimed.

However, Luinstra et al (GB 2221853A) **teach** Claus reaction furnace (Title). As shown in the Figure below, it has a rigid permeable catalyst structure 13 arranged with combustion chamber 15 where rigid **permeable** catalyst structure includes a support and a catalytically active substance (page 3, line 16-17). If required the inner wall of the housing 1 can be lined with suitable refractory material (page 4, line 32-33).



The advantage of this structure of Claus reaction furnace is to produce during the normal operation a gas mixture which has a reduced amount of organic sulphur compounds (page 3, line 10-12).

Therefore, it would have been obvious at time of the invention to install the catalystic chamber horizontally in line with the combustion furnace as disclosed by Luinstra et al for the Claus furnace 12 disclosed by Heisel et al in order to achieve the advantage cited herein above. It would be obvious to have checker bricks to delimit the catalytic chamber because of chosen known materials for suitable, as further evidenced by Mather et al (US 2365893) that checker bricks forms the space for the catalyst bed because of relative high heat capacity (Figure 2, page 5,. Col. 2, line 65-67).

As to the Claus plant being operated with only a single reaction oven, and that a working temperature of less than 250 °C is set in this oven in the method in **independent claim 1**, the reaction oven to be operated in a temperature range between 200 °C and 230 °C in **claim 2**, as

shown in the Figure above, Heisel et al (US05628977A) disclose a single catalytic reactor 23. Advantageously, the 1st catalytic reactor is run with a starting temperature of 170 to 220 °C (Col. 5, line 9-10). This starting temperature of catalytic reactor 23 is between 1 to 10 °C., preferably between 3 to 5 °C higher than the temperature of gas stream in pipe 21 (Col. 6, line 42-45).

As to the process gas that leaves the reaction oven, after precipitation of the condensed sulfur, being passed back into the coke oven gas to be cleaned, ahead of gas scrubbing, with a residual content of hydrogen sulfide that was not converted in the reaction oven in the method in **independent claim 1**, Heisel et al (US05628977A) disclose the afterburning for the process gas leaving the reaction oven, after precipitation of condensed sulfur. Heisel et al **do not teach** passing the process gas back into the coke oven gas stream ahead of gas scrubbing as claimed.

However, Keller et al (US 20020134706A1) **teach** any remaining H_2S, SO_2, sulfur or other sulfur compounds in the Claus plant effluent to be either incinerated to SO_2 and discharged to the atmosphere, or incinerated to SO_2 and absorbed by chemical reaction, or converted by hydrogen to H_2S and recycled or absorbed by an alkanolamine solution. This is accomplished by various Claus "tail gas" treatment units, which improve the efficiency of sulfur removal from the gas discharged to the atmosphere ([0013], line 1-8).

Therefore, it would have been obvious at time of the invention to replace the afterburning unit process of Heisel et al by the process of converting the tail gas of Claus plant by hydrogenation and recycled back to H_2S reactor of Tjoa et al based on their interchangeability as recognized functional equivalence as processes in Claus plant tail gas treatment.

As to waste heat boiler having 1st tube bundle composed of heat exchanger tubes, through which the process gas that exits from the Claus boiler flows, that the waste heat boiler has a second tube bundle composed of heat exchanger tubes, through which the process gas that exits from the reaction oven flows, and that the tube bundles are disposed in a common steam generator chamber, in which low-tension steam is generated in **claim 4**, Heisel et al (US05628977A) disclose cooling by evaporation of feed-water 15 to steam 16 for process gas from Claus furnace and cooler 25 for the process gas from catalytic reactor 23 shown in Figure 2 above. It is well known in the art that condenser has design of heat exchanger tubes in the art. Heisel et al do not disclose the two condensers 25 and one with Claus furnace to be in common steam generator chamber, it would be obvious to have them together in one chamber as well as

separated in two units because rearrangement of parts renders obviousness. *In re Kuhle, 526 F.2d 553, 188 USPQ 7 (CCPA 1975).*

As to elemental sulfur being drawn off from waste heat boiler in liquid form in **claim 5,** Heisel et al (US05628977A) disclose condenser used to condense the sulfur in the gas streams, therefore, the sulfur is condensed to liquid form from gas form – condensation.

As to a partial stream being branched out of the hot process gas that leaves the Claus boiler and mixed into the process stream that is passed to the reaction oven to heat it in **claim 6**, Heisel et al (US05628977) disclose, a part of the Claus reactor waste gas is limited quantitatively by control valve 14 on pipe 13, drawn off hot from Claus furnace, while the residual Claus reactor waste gas is cooled by evaporation of boiler feed-water 15 and drawn off via pipe 18. The steam generated by evaporation of boiler feed-water accumulates in pipe 16. With the cooling of condensed elementary sulfur, it is drawn off via pipe 17 from Claus furnace 12 (Col. 6, line 25-34). The Claus furnace waste gas at hand in pipe 21 after cooling 19 is mixed with hotter Claus furnace waste gas from pipe 13 and fed via pipe 22 to catalytic reactor 23. Control valve 14 is adjusted in this case in such a way that the gas stream in pipe 22 has a temperature of 170 ^{o}C to 220 ^{o}C (Col. 6, line 37-42).

Response to Arguments

(3). Applicant's arguments, see pages 5 & 6, current Remarks, filed on 5/7/2009, with respect to the rejection(s) of claim(s) 1 under 103 in view of combined teaching Tjoa et al (US 3767766), Heisel et al (US 5628977A), Keller et al (US 20020134706A1) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Tjoa et al (US 3767766), Heisel et al (US 5628977A), Keller et al (US 20020134706A1), Luinstra et al (GB 221853A), Mather et al (US 2365893).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to IVES WU whose telephone number is (571)272-4245. The examiner can normally be reached on 8:00 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Examiner: Ives Wu
Art Unit: 1797
Date: July 27, 2009

/Frank M. Lawrence/
Primary Examiner, Art Unit 1797